FARMING OF FORAGE CROPS FOR RABBIT IN HYDROPONICS SYSTEM

Project Proposal submitted to

Department of Agricultural Engineering

Purwanchal Campus, Dharan

By

Arjun Gautam (072/BAG/08)

Bhola Paudel (072/BAG/10)

Pradip Adhikari (072/BAG/30)

Pralad Phuyal (072/BAG/31)

Roshan Thapa (072/BAG/37)

Shasank Pokharel (072/BAG/42)

DEPARTMENT OF AGRICULTURAL ENGINEERING

INSTITUTE OF ENGINEERING

PURWANCHAL CAMPUS, DHARAN

DECEMBER, 2017

Table of Contents

1. INTRODUCTION 3
    I. What is Hydroponics? 3
    II. Statement of problem 3
    III. Limitations 3
    IV. Project scope 3
2. LITERATURE REVIEW 4
3. OBJECTIVES 5
    I. General Objective 5
    II. Specific Objective 5
4. COMPONENTS LIST 6
    I. Structural Components 6
    II. Mechanical Components 6
    III. Electronics Components 6
5. METHODOLOGY 7
6. PROJECT TIMELINE 8
7. DESIGN OVERVIEW 9
8. DESIGN ANALYSIS 10
9. EXPECTED OUTCOME 11
10. REFERENCES 12

INTRODUCTION

I. What is Hydroponics?

Hydroponics is a subset of hydroculture, the method of growing plants without soil, using mineral nutrient solutions in a water solvent. Terrestrial plants may be grown with only their roots exposed to the mineral solution, or the roots may be supported by an inert medium, such as perlite or gravel. The nutrients in hydroponics can come from an array of different sources; these can include but are not limited to byproduct from fish waste, duck manure, or normal nutrients.

II. Statement of problem

Due to rapid uncontrolled urbanization in Nepal, the farming land is decreasing day by day which has significantly affected the production of forage crops. Lack of adequate soil and climatic conditions has also made it hard to grow forage crops for commercial animal husbandry. One of the affected sectors is rabbit farming, a relatively new animal husbandry practice in Nepal. With almost no land for growing fodders, rabbit farming, despite huge potential and demand for meat in the market has not been able to expand in urban areas. Some alternative of land farming like hydroponics is unheard or considered too expensive by the farmers.

III. Limitations

The limitations of the project are listed below:

1. **Expertise**– This project comprises of engineering students with self-taught knowledge about hydroponics. Lack of sufficient involvement of experts of relevant field, biologist and famers creates a challenge.
2. **Controlled environment –** It could be difficult to maintain required humidity and temperature inside the KOICA lab (our research space).
3. **Problem of resource –** Unavailability of nutrient in local market and inadequate water supply near the site possesses a challenge.
4. **Finance and funding –** As the project is based on research, lack of adequate funding might be one of the major constraint.

IV. Project scope

The project will consist of growing hydroponics fodder for rabbit in college lab. The hydroponics system will be constructed using locally available materials as much as possible. The parameters of the research project will be economic feasibility, sustainability, nutrient content in fodder and impact of fodder on rabbit health. The project will be completed by 20th February, 2018.

LITERATURE REVIEW

The word hydroponics consist of two words “hydro”, meaning water, and “ponos”, meaning labor, i.e. this method of gardening does not use soil

One of the earliest examples of hydroculture is the Hanging Garden of Babylon constructed between 8^{th} and 7^{th} century BC. Also, the Chinampa lakes in Mexico used the principle of hydroculture.

The earliest published work on growing terrestrial plants without soil was the 1627 book *Sylva Sylvarum* or a natural history by *Francis Bacon* which led to water culture becoming a popular research technique. In the mid-19^{th} century, growth of terrestrial plants in mineral nutrient solution become a standard research and teaching technique and still widely use. Solution culture is now considered a type of hydroponics where there is no inert medium

In 1929, *William Frederick Gericke* of UC Berkeley began publicly promoting solution culture for agro-crop production. He also introduces the term hydroponics, water culture, in 1937, proposed to him by *W.A. Setchell*. In 1940, *Gricke* published the book *Complete guide to soil less gardening*. To other plant nutritionists at UC Berkeley, Dennis R. Hoagland and Daniel I. *Arnon* continued the research of *Gricke* and developed several formulas for mineral nutrient solutions, known as Hoagland solution. Modified Hoagland solutions are still in use.

One of the earliest successes of hydroponics occurred on Wake Island, where it was used to grow vegetable of passengers of Pan American Airlines. In the 1960s, Allen Cooper of England developed the Nutrient Film Technique (NFT). In recent decades, NASA has done extensive hydroponics research for its controlled ecological life support system (CELSS). Hydroponics is proposed to be installed on Mars using LED lighting to grow in different color spectrum with much less heat.

There are many techniques employed for hydroponics. Some of the widely used techniques are static solution culture, continuous flow solution culture -NFT technique, wick systems, deep water culture (DWC), Ebb and flow (Flood and Drain) and aeroponics.

OBJECTIVES

I. General Objective

- To develop semi-automated hydroponics system by using locally available materials.

II. Specific Objective

- To grow forage crops for rabbit in hydroponics system.
- To compare the nutrient content of soil-grown and hydroponics fodder.
- To study economic feasibility and sustainability of hydroponics system.
- To study the possibility of an alternative design in hydroponics to suit the need of Nepalese farmers.

COMPONENTS LIST

I. Structural Components

S.N.	Name of component	Amount required
1.	L-Bend metal	38 meters
3.	Tin/Aluminum sheet (5 mm thick)	--
4.	Wood	--
5.	Nut and Bolts	0.5 kg
6.	Bamboo	--

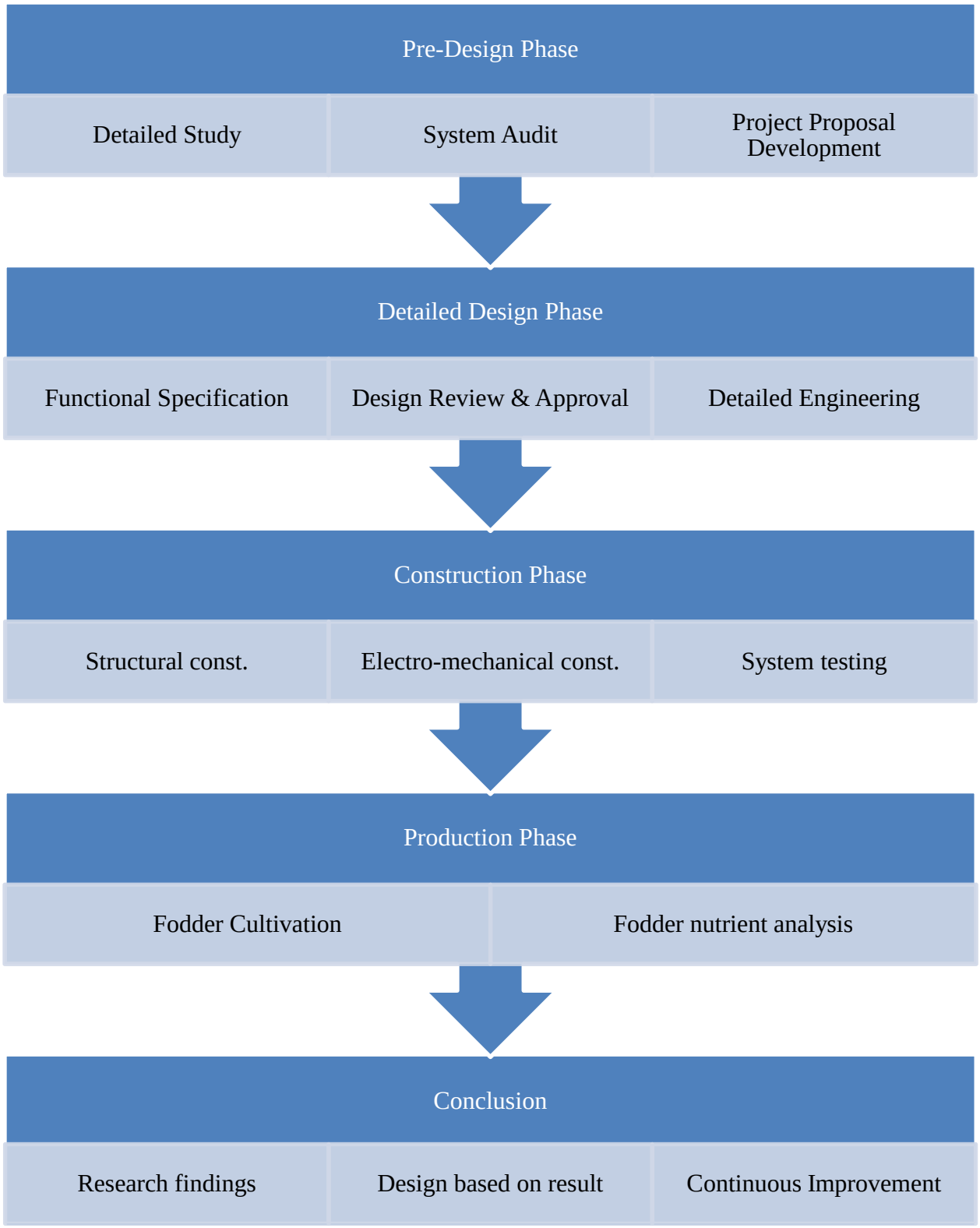
II. Mechanical Components

S.N.	Name of component	Amount Required
1.	Water pump (DC)	1
2.	Normal pipes	20 meters

III. Electronics Components

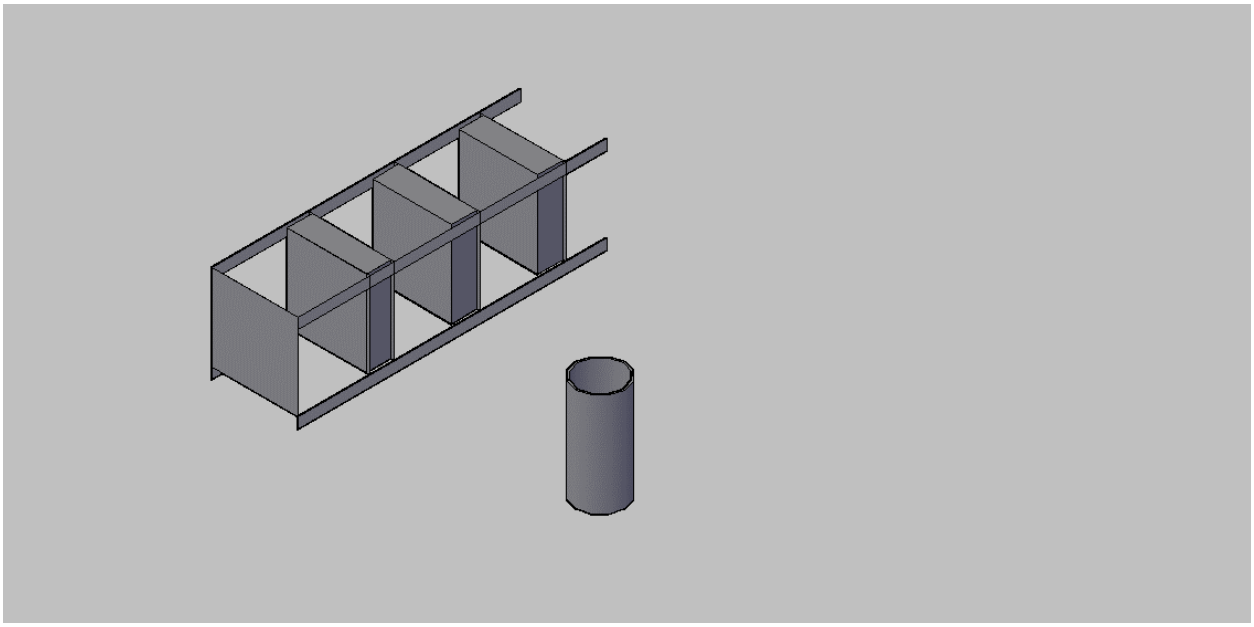
S.N.	Name of component	Amount required
1.	Microcontroller (Arduino)	1
2.	Water-level indicating sensors	15 pieces (1 per tray)

METHODOLOGY



PROJECT TIMELINE

DESIGN OVERVIEW



Tray – The compartment which holds the nutrient solution required for plants. There are 3 trays in each of our proposed structure.

Storage Tank: The compartment which stores water. It is here the nutrients are mixed to form solution.

Pumping set: The motor which pumps the nutrient solution from the storage tank to the trays.

Base plate: The plate at the bottom of the structure. It helps in providing stability to the structure and the area could be used for placing pumping motor, storage tank or electronics components.

Roof plate: The plate at the top of the structure. A network of piping system is placed here to maintain the pressure head in each tray.

DESIGN ANALYSIS

Economy and production efficiency is the main emphasis of our design. Also, a lot of consideration has been given to use locally available materials as much as possible. For that reason, a simple yet economic design that has a proven efficiency has been chosen. The structure based on this design can be made from metal pipes, L-bend metal, wood and bamboo too. As bamboo is widely available, cheap and strong too, and even though it is not usually preferred for hydroponics system, its use in construction will ultimately bring down the initial cost.

EXPECTED OUTCOME

The expected outcomes of the project are listed below:

1. The time required for growing forage in hydroponics would be upto 4 times less compared to time required in soil (one cycle).
2. The nutrient content in hydroponics fodder would be significantly higher compared to that grown in soil.
3. The installation cost of hydroponics system would be upto 80% of standard system by using locally available construction materials.
4. Development of new design on hydroponics to suit Nepalese context.

REFERENCES

1. Department of Agriculture, Forestry and Fisheries. 2011. Hydroponic Vegetable Production
2. Department of Agriculture. Hydroponics. Ministry of Agriculture, Sri Lanka.
3. An Introduction Hydroponics at Home https://www.thebetterindia.com/60350/soil-less-hydroponic-gardening-india/
4. Nepal Population (2017, 2018) - Worldometers www.worldometers.info/world-population/nepal-population/
5. Nicholls, R. 1990. Beginning Hydroponics: Soilless Gardening. Running Press, Philadelphia.